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*On the POWER of FIXED CAUSTIC ALKALINE  
SALTS to preserve the FLESH of ANIMALS from  
PUTREFACTION. In a Letter to the Reverend  
GEORGE GRAYDON, &c. from the Reverend HUGH  
HAMILTON, D. D. &c.*

S I R,

THE ingenious paper you communicated to the Royal Irish Academy, on the fishes that have been found enclosed in stone in the quarry at Monte Bolca, brought to my recollection some observations I had made many years ago, on the power that alkaline salts, even when highly caustic, have to preserve animal substances. I mentioned to you some of these observations, and you have desired I should give you a fuller account of them, as you thought they in some measure coincided with the theory you had delivered, concerning the preservation of the more solid parts of the fishes found in quarries of lime-stone.

Read April  
5, 1794.

I CAME

I CAME to the knowledge of this power of alkaline salts, I may say, accidentally. I had a wish to procure some kind of alkaline liquor that might be safely taken, for the purpose of correcting acidities in the stomach. I knew that a solution of salt of tartar was exceedingly offensive to the taste, and if it was of strength sufficient to neutralize any quantity of acid in the stomach, it could not be swallowed without danger to the passages, from its causticity. It occurred to me, that its causticity might probably arise from its having a strong affinity to something or other, to get at which it burned or destroyed the texture of the flesh. If this should be the case, it was natural to suppose, that this salt, if intimately mixed with flesh, would saturate itself with whatever it was that it had such a strong appetite for, and, being so saturated, it would act no further on our flesh, and might, without danger, be taken inwardly. To try this, I first enclosed some bits of lean raw mutton in a vial with a strong solution of salt of tartar; but, after standing several days, no such alteration as I expected appeared in the liquor. I was willing to account for this, by supposing the salt had a greater affinity to the water than to any thing in the flesh; I therefore cut some flesh from the breast of a turkey, roasted the day before, and made it as dry as I could; this I pounded in a mortar, adding by degrees some dry and finely powdered salt of tartar\*, until I thought there was enough, for I had no rule to judge by; the mixture grew moist,

\* This salt had been sent to me rendered caustic by quick-lime, though I had not desired it.

moist, and when it was sufficiently pounded, I spread it into a thin cake on an earthen dish, and set it before the fire, and it soon became quite dry. I found it had then a saponaceous mild taste, for the taste of the salt was scarcely perceptible. Having macerated this flesh in warm water, and poured off the clear liquor, I found it effervesced with vinegar, which shewed, that the salt was not so far neutralized, but that it would unite itself with an acid, so that I considered it as a mild alkaline liquor, such as I sought for: However, that I might have an opinion from a person of skill on the subject, I wrote to my late worthy and ingenious friend, Doctor Mc. Bride, and acquainted him with the preparation I had made, and the intention of it. In his answer, he was pleased to say he approved of the idea, and would make some of the liquor I described, and let me know what he thought of it. He afterwards wrote to me, and said he had tried the alkaline liquor, and thought it might prove a useful medicine, particularly as it might be mixed with milk and given to children, who have often acids in their stomachs. He also mentioned a physician then in Dublin, to whom he recommended the liquor, and who had found great benefit from it. I first made this liquor in the year 1771, and in the year 1777, being then at Bath, I met with an account of some experiments made by Mr. Bewly, an ingenious chymist, which plainly proved that fixed air is an acid, and saturates alkaline salts; this at once informed me, what it was in the flesh of an animal, that alkaline salts had such a strong affinity to. At the same time I got from London one of Doctor Nooth's glass machines for impregnating water with fixed air, and to the

water I added salt of tartar; after this, you may suppose, I thought no more of my alkaline broth, having got a way of obtaining what I wanted in a much more elegant manner.

I WOULD not have given you this long detail of a matter now uninteresting, had you not desired me to write the whole of what I had told you in our conversation. The only thing now worth attention in the experiment I have related is, that it discovered a power in even caustic alkaline salt to preserve flesh, I may say, incorruptible; though it has been generally imagined that such salts would consume it. I have some flesh prepared with these salts in the year 1772; for, finding some bits made the year before had continued unaltered, I made some more, and laid it by to see how long it would keep, and what alterations it would undergo. I made it into a cake, and when quite dry I cut it into round bits about the size of half a crown, and put them into a drawer in my desk; I shewed some of them to Mr. Kirwan the summer before last, when I had the honour of receiving a visit from him at Armagh, and a few months ago I found several pieces in another drawer, *where they have lain near two and twenty years, and remain unaltered; when they are broken, the pieces hang together by fibres, and look like a piece of plaster taken from a wall; the fibrous or stringy parts of the flesh do not seem to have been corroded or dissolved by the salt.*

AFTER I knew that fixed air was an acid, and saturated alkaline salts, I began to form conjectures about the means by which

which these salts had so entirely prevented putrefaction in the flesh to which they were united. Animal substances afford much volatile alkali, and now they are known to contain also a volatile acid gas. While these two volatile principles continue united with each other, they may prevent any material change from taking place in the substance; but if one of them by any means escapes, the other will follow; the acid seems to be the most volatile, and escapes first, though we may not be sensible of its escape, because it has no such strong smell as the alkali has. The letting loose these volatile principles seems to be the beginning of putrefaction. If this be the case, we may see the reason why flesh, growing putrid, is restored to sweetness by fixed air, that acid replacing what had escaped, and retaining the volatile alkali. It is probably on this account that the ærial acid is found to be of use in stopping the progress of some putrid diseases; it seems to act as a sort of pickle. If vinegar preserves flesh by keeping its volatile alkali united with this acid which is not volatile, we may expect a fixed alkali will have a like effect in preserving flesh, by expelling the weaker volatile alkali, and uniting itself to the volatile acid, which will therefore be retained. This I found to be really the case; for, while the flesh and alkali were combining in the mortar, a very strong smell arose like that of *sal volatile*; and at one time that I used a brass or metal mortar, I perceived its edges to be tinged with blue, which shewed the metal had been affected by a volatile alkali.

THERE seems to be a good reason why fixed alkaline salts should preserve flesh much longer than any fluid acid, such as vinegar, can do; for when the alkaline salt combines with the flesh, it expells what is volatile, the mass grows hard, and it is easily reduced to a state of dryness, in which no sort of fermentation or any intestine motion can take place, and therefore there is nothing that can effect a change in this compound substance: whereas when an animal or vegetable substance is immersed in vinegar, a very heterogeneous mixture is formed, which, in length of time, will be very apt to run into a sort of fermentation, with an intestine motion among the minute particles, and this will bring on some change in the texture of the substance, and every fermentation, when long continued, ends in putrefaction, which, indeed, is said to be the last stage of fermentation.

WHETHER the conjectures I have offered on this subject be well or ill-founded is but of little consequence; you may rely on the facts I have mentioned, and if you think they throw any light on your theory, you may, if you think proper, submit to the consideration of the Royal Academy this paper as an appendix to your's.

I am, Sir,

Your very humble servant,

Dublin,  
April 2, 1794.

HUGH HAMILTON.